CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. A method for detecting molecules, the method comprising:

a) determining the electronic status of a semi-conductor;

b) establishing electronic communication between the molecules and the semiconductor;

c) subjecting the semi-conductor to energy influx;

d) redetermining the electronic status of the semi-conductor.

2. The method as recited in claim 1, wherein the energy level is determined optically.

3. The method as recited in claim 1, wherein the energy level is determined electrically.

4. The method as recited in claim 1, wherein the semiconductors are are octahedral metal oxides.

5. The method as recited in claim 1, wherein the semiconductors are metal oxides selected from the group consisting of TiO_2, VO_2, ZrO_2, Fe_3O_4, MnO_2, NiO, CuO, and combinations thereof.

6. The method as recited in claim 1 wherein bidentate moieties are positioned intermediate to the molecules and the semiconductors.

7. The method as recited in claim 6, wherein the moieties are dihydroxyl phenyls selected from the group consisting of 1,2 dihydroxyl phenylamine, 1,2-dihydroxyl phenyl alanine, 1,2-dihydroxyl benzoic acid, 1,2-dihydroxy glycine, 1,2 dihydroxy benzyl amine, and combinations thereof.

8. The method as recited in claim 1, wherein the semiconductor further comprises a valence band and a conductive band, whereby the valence band contains electrons.

9. The method as recited in claim 8, wherein the energy influx induces the electrons to relocate to the conductance band.

10. The method as recited in claim 1 wherein the molecules are electron donators.

11. The method as recited in claim 1 wherein the molecules are electron acceptors.

12. A method for detecting biological molecules, the method comprising:

a) supplying a semi-conductor having a first energy level and a second energy level and whereby the first energy level corresponds to a first optical characteristic of the semi-conductor;

b) establishing electrical contact between the semi-conductor and the molecules;

c) causing electrons to move from the molecule to the second energy level; and

d) monitoring any change in the first optical characteristic.

13. The method as recited in claim 12, wherein the biological molecule extracts electrons from the semi-conductor.

14. The method as recited in claim 12, wherein the biological molecule donates electrons to the semi-conductor.

15. The method as recited in claim 12, wherein a bidentate moiety is intermediate to the semi-conductor and the biological molecule.

16. The method as recited in claim 12 wherein a moiety capable of withdrawing electrons from the biological molecule is in electrical communication with the molecule.

17. The method as recited in claim 12 wherein a moiety capable of donating electrons to the biological molecule is in electrical communication with the molecule.

18. The method as recited in claim 12 wherein the semiconductors are octahedral metal oxides.

19. The method as recited in claim 12, wherein the semi-conductor is between 1 and 20 nanometers in diameter.

20. The method as recited in claim 12 wherein the step of causing electrons to move results in the formation of an oxidative region on the semi-conductor.

21. The method as recited in claim 20, wherein the oxidative region facilitates cleavage of molecules.

22. A method for detecting target moieties *in situ,* the method comprising:

a) binding biological material to nanocrystalline semiconductor particles, wherein the material has an affinity to the target moiety;

b) facilitating entry of the bound material into an organelle; and

c) subjecting the semiconductor to radiation sufficient to produce a charge pair separation on the semiconductor's surface.

23. The method as recited in claim 22 wherein the biological material is genetic material.

24. The method as recited in claim 22 wherein the organelle is a nucleus of a cell.

25. The method as recited in claim 22 wherein the charge pair separation is detected via Electron Paramagnetic Resonance.

26. The method as recited in claim 22 wherein the charge separation is detected via an electronic signal.

27. The method as recited in claim 26 wherein the signal can be amplified.

28. A method for manipulating biological material in vivo, the method comprising:

a) attaching a semi-conductor to a first biological moiety to create a construct;

b) inserting the construct into a living organism;

c) allowing the construct to migrate to the biological material;

d) creating a plurality of charges on the construct, wherein the size of the charges and distances between the charges cause the biological material to change in structure.

29. The method as recited in claim 28 wherein the biological material comprises molecules selected from the group consisting of nucleotides, nitrogenous heterocyclic bases, amino acids, and combinations thereof.

30. The method as recited in claim 28 wherein the charges are created by subjecting the construct to radiation.

31. The method as recited in claim 30 wherein the radiation has an energy greater than 1.6 eV.

32. The method as recited in claim 28 wherein the radiation has energy ranging from about 1.6 eV to 10 eV.

33. The method as recited in claim 28 wherein the step of creating a plurality of charges further comprises subjecting the construct to radiation selected from the group consisting of white light, ultra violet light, X-rays or gamma rays, alpha rays, gamma rays, and combinations thereof.

34. The method as recited in claim 28 wherein the biological material is nucleic acid and the construct changes the nucleic acid by cleaving it.

35. The method as recited in claim 34 wherein the cleavage occurs when the semiconductor accumulates electrons from the first biological moiety.

36. The method as recited in claim 28 wherein the semiconductor is a

metal oxide selected from the group consisting of TIO_2, ZrO_2, VO_2, MnO_2, NiO, ZnO, CuO, FeO_4 and combinations thereof.

37. The method as recited in 1 wherein the biological molecule is nucleic acid having base sequences interspersed with guanine.

38. The method as recited in claim 30 wherein the source of radiation is a radioactive isotope selected from the group consisting of phosphorus-32, iodine-123, iodine-131, sulfur-35, selenium-75, technetium-99, yttrium-90 and combinations thereof.

39. The method as recited in claim 37 wherein the radioactive isotope is covalently attached to the semi-conductor.